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(54) **Segmental pulpstone and abrasive segments**

(57) An improved segmental type pulpstone (10) has circumferentially faced spiral grooves 20b (30b) (40b) In the outer abrading surface 20c (30c) (40c) thereof for collecting and allowing deeper penetration and circulation of shower water to wash away ground pulp, reduce plugging of the pores, cool and prevent overheating of the abrasive segments 20 (30) (40) the attaching bolts 18 and the resulting spalling and/or loosening of the abrasive segments from the supporting core (12) (12').

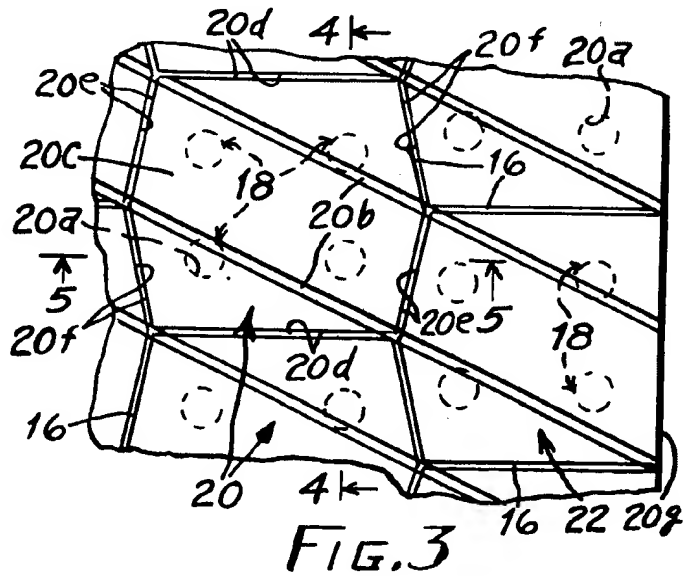

FIG. 3

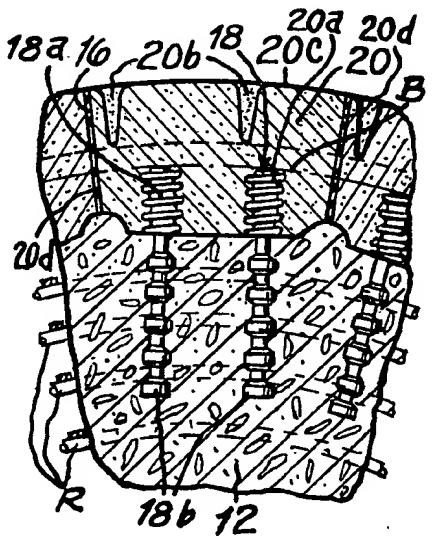

FIG. 4

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The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

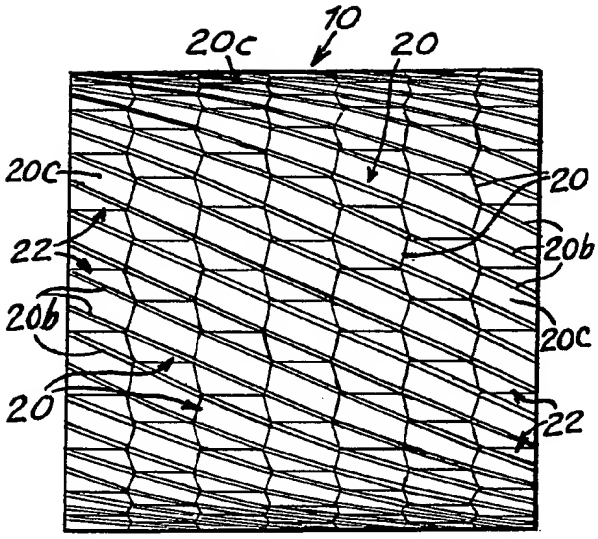

FIG. 1

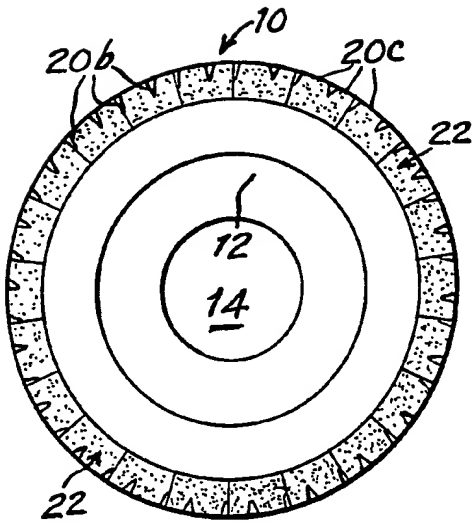

FIG. 2

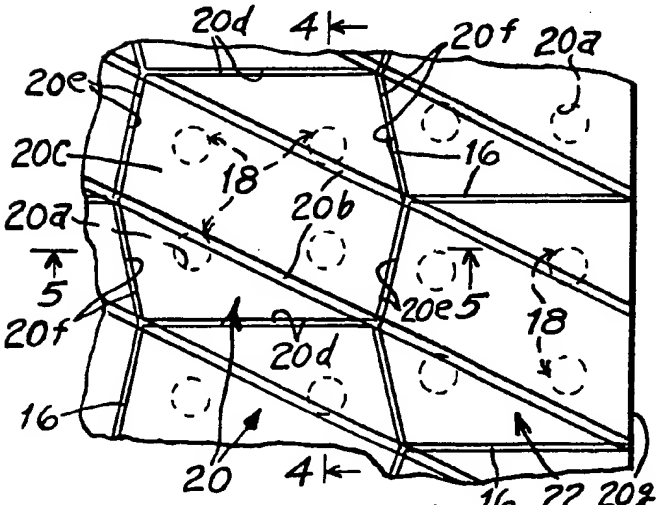

FIG. 3

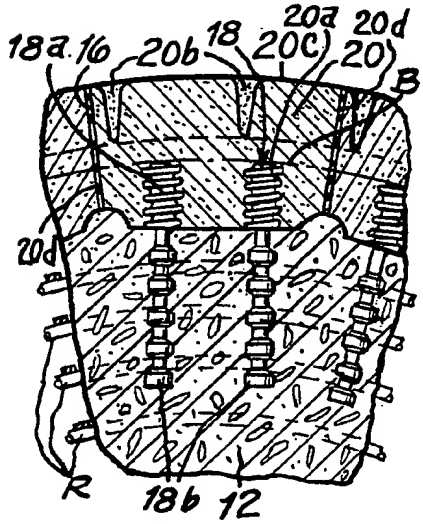

FIG. 4

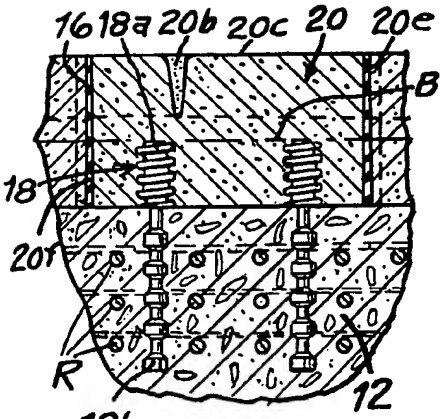

FIG. 5

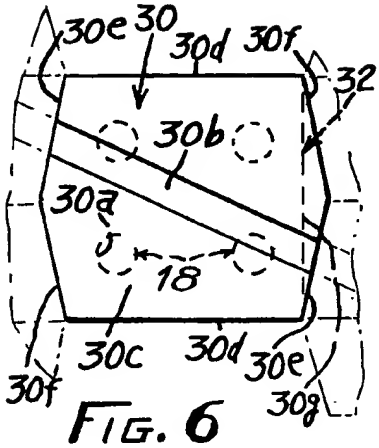

FIG. 6

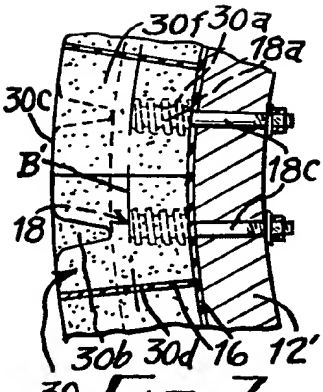

FIG. 7

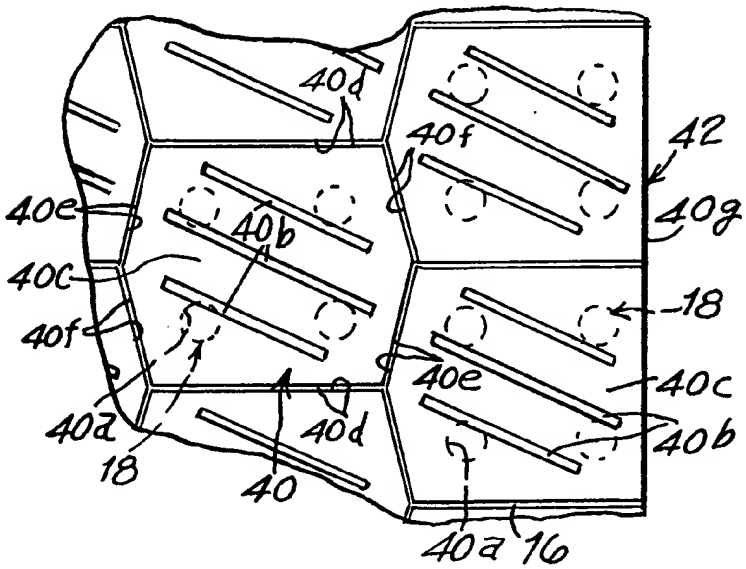

FIG. 8

SPECIFICATION

Segmental pulpstone and abrasive segments

The invention relates to segmental type pulpstones for grinding wood pulp wherein bonded abrasive segments are secured to a central core by bolts with a different rate of thermal expansion and which in use are normally flooded with shower water to flush ground pulp from the pores, to prevent overheating, spalling and loosening of the segments from the core.

To this day many segmental type abrasive pulpstones are constructed by attaching bonded abrasive segments to both cylindrical metal and concrete cores with metal bolts or studs like fastener means of various forms. However, problems such as overheating, breakage, spalling, and loosening of the segments have not been entirely overcome and arise when the metal bolts fastened to the core and segments become overheated and expand at a greater rate than the abrasive segments and core.

The problem of overheating usually results when the large volume of water fails to wash away the ground pulp and allows small particles thereof to enter and eventually plug the pores in the abrading surface. Hence, the large volume of shower water normally directed against and abrading surface cannot penetrate, absorb, and remove excess heat generated during grinding pressure contact between the logs of pulpwood forced against the abrading surface. U.S. Patents 2,745,226, 2,769,286, 2887,276 and German Offenlegungsschrift 2,853,716 disclose a partial solution to the problem of overheating with respect to segmented pulpstones wherein abrading segments are bolted in spaced relationship to a hollow cylindrical shell or core. Water is supplied to the interior of the hollow core having radial passages in the wall or bolts for directing water under pressure to and between the non-abrading side surfaces of adjacent segments. However, with respect to pulpstones of the type disclosed in U.S. Patent 2,421,885 the cooling water cannot pass readily from the interior of the solid concrete core to the abrading segments, and must rely solely on the exterior shower water to wash away pulp and prevent overheating of the pulpstone.

The applicant's invention is directed to an improved segmental pulpstone provided with deep circumferentially spaced grooves that collect and increase the penetration and effectiveness of the shower water. Hence, the operating temperature of the abrasive segments and attaching bolts is more uniformly controlled and maintained at a safe level.

In U.S Patents 1,132,258 and 3,132,815 there are disclosed pulpstones provided with either a continuous helical or circumferentially spaced shallow grooves or furrows extending across the abrading surface at an angle to the axis in addition to the shallower and more conventional grinding, sharpening or burr pattern. However, the furrows or grooves which have a maximum depth of about 1" (25mm) are provided for the specific purpose of quickly collecting and disposing of the wood fibers to prevent regrinding thereof. Further, the pulpstones are not made up of abrasive segments attached to a core by bolts or studs with a different rate of thermal expansion and affected by overheating of the abrasive segments attached thereto.

A rotatable segmental grooved pulpstone comprising preformed bonded abrasive segments and attached bolts with a different rate of thermal expansion assembled about and attached to a core adapted for mounting the pulpstone on a drive spindle assembly for rotation. Each bolt has a convoluted or thread-like end portion inserted or threaded into and fastened to an inner non-abrading portion of an abrasive segment and an opposite end portion extending therefrom adapted for attachment to the core. A plurality of relatively deep circumferentially spaced grooves extend radially into and continuously across the outer abrading portion of the pulpstone and each abrasive segment at an angle to the rotational axis and opposite radial sides of the segment.

In rotational use the deep grooves collect and circulate the cooler shower water therealong into and through the porous abrading and non-abrading portions of the segment about the bolts. The cooler shower water flushes wood fibers out the grooves, is centrifugally forced outwardly and thereby removes particles of ground pulp from the pores at the abrading surface. Hence, the shower water circulates more freely to carry the generated heat away and thereby prevents overheating of the abrasive segments, the attaching bolts, and the resulting loosening spalling and/or breaking of the abrasive segments.

Figure 1 is a front view of a grooved segmental pulpstone constructed and grooved according to the invention.

Figure 2 is an end view of the grooved segmental pulpstone of Figure 1.

Figure 3 is an enlarged partial view of the grooved abrading surface adjacent one end of the pulpstone showing the interfitting arrangement, configuration construction of the abrasive segments, with a pair of diagonal grooves and location of the attaching bolts.

Figures 4 and *5* are sectional views through a portion of th pulpstone taken on line 4-4 and 5-5 respectively of Figure 3 and showing double grooved abrasive segments secured to a reinforced solid core by bolts threadly attached to the segments and embedded in the core.

Figure 6 is a plan view of a modified abrasive segment, provided with but one groove in the abrading portion and suitable for constructing segmental pulpstone with fewer grooves.

Figure 7 is a partial sectional view showing a single groove abrasive segment of the invention secured to a hollow cylindrical core by nuts and bolts threaded to the abrasive segment and modified to extend through apertures in the wall of the core; and,

Figure 8 is a plan view of assembled center and end segments with three diagonal grooves for constructing another embodiment of the pulpstone.

Shown in the drawings is an improved peripherally grooved rotatable segmental pulpstone 10 of the invention for grinding wood pulp. The pulpstone 10

comprises a cylindrical center or core 12 including a central bore 14 constructed and adapted about its rotational axis and opposite ends for attachment to any suitable conventional drive spindle in the well known manner. Assembled about, spaced or separated by strips of known joint filler material 16 and secured by metal bolts 18 of known design to the outer peripheral or circumferential surface of the core are interchangeable, reversible and interfitting six-sided or hexagonal center and, five sided or pentagonal outer or end bonded abrasive segments 20 and 22 respectively.

The strips of joint filler material 16 may be of any suitable flexible deformable type but is preferably the cellular vulcanizable rubber material containing granules of cork disclosed in U.S. Patent 2,054,771.

Depending on the application and type of pulpstone, the attaching metal bolts 18 may be one of the known conventional types disclosed in U.S. Patent 2,421,885, 2,745,226 and 2,769,286. Each bolt 18 has a threaded or thread-like convoluted head or end portion 18a and either an opposite end portion 18b with axially spaced annular portions and intervening grooves adapted to be embedded in a solid concrete core as shown in Figure 4 or as shown in Figure 7, an opposite threaded end portion 18c including a nut and washer adapted for attachment to a hollow cylindrical core 12'.

Additionally, each of the abrasive segments 20 and 22 has at least one relatively deep groove 20b extending radially into and across the outer interrupted abrading portion 20c thereof, at a predeterminted angle and position relative to a side thereof that aligns it with the groove of the adjacent segment, and a similar groove provided in the filler strip 16 there between. Hence, collectively, the grooved abrasive segments 20 and 22 and grooved filler strips 16 therebetween provided the pulpstone 10 with a plurality of relatively longer continous grooves 20b and intervening abrading portions 20c circumferentially spaced around and extending the entire axial length or width of the interrupted abrading portion of the pulpstone and each of the abrasive segments therein at an angle to the rotational axis of the pulpstone and logs of pulpwood engaged thereby. Typically, the useable and reducible abrading portion of a trued pulpstone 10 is no less than 2-9/16" (6.5 cm). However, each abrasive segment 20 and 22 has an initial radial depth before truing of about 5-1/4" (13.3 cm) and an abrading portion of about 3" (7.6 cm) extending inwardly to ends of the threaded bolt heads 18a and holes 20a, defining the outermost circumferential boundary B of the inner non-abrading portion and depth of the holes 20a and threads 18a of about 2-1/4" (5.7 cm).

Although the initial depth of the abrading portion may and will vary during use, the grooves 20b are of sufficient depth to place the bottoms thereof within and no more than 1-1/4" (3.17 cm) from the outermost circumferential boundary B defining the ends of the bolt heads 18a.

Referring to Figures 1-5, the groove 20b, may be of any suitable conventional shape. However, they are preferably V-shaped to prevent entrapment and enhance easy removal or release of the wood pulp fibers therefrom. Typically, each molded groove 20b has an initial outwardly flared or curved elongated entrance about 3/4" (19 mm) wide, opposite tapered sides extending from convex entrance surfaces of about 1/2" (12.7 mm) radius to a concave bottom of about 3/16" (4.7 mm) wide and 3/32" (2.38 mm) radius located about 9/16" to 1-1/16" (1.42 to 2.7 cm) from the boundary B between the abrading and non-abrading portions and an initial maximum depth of about 2 to 2-1/2" (5.07 to 6.34 cm). Hence, regardless of wearing away and reduction of the abrading portion, the bottom of the grooves 20b are permanently located relatively close to the boundary B and heads 18a of the bolts 18 and allow cooler shower water to circulate through the pores, thereof, and carry heat away to prevent overheating.

Referring to Figures 3 and 4, typically each inner or center hexagonal abrasive segment 20 of a completed and trued grooved pulpstone 10 approximately 67" (170.8 cm) diameter by 69" (175.26 cm) axial length is symmetrical about a central radial plane extending from the axis of the pulpstone. It also has a maximum axial length of about 10.8" (27.46 cm) at the central radial plane of symmetry, a circumferential width of about 9.5" (24.1 cm) and a radial thickness of about 5" (12.7 cm) at the central radial plane.

Preferably each segment 20 comprises a spaced pair of slightly tapered V-shaped diagonal grooves 20b, adjoining interrupted diagonal abrading portions 20c, a pair of slightly tapering opposite radial sides 20d including upper edges thereof, of equal length, extending parallel to each other and to the central radial plane and two pairs of slightly tapering diagonally opposite sides 20e and 20f with upper edges of equal length extending parallel to each other and at substantially the same angle from the central radial plane of symmetry. Each of the grooves 20b extends parallel to the other in diagonally opposite directions across the segment from a center point, corner, or apex, situated at each opposite end of the segment and intersection of a diagonal side 20e, a diagonal side 20f with the central radial plane to a diagonally opposite side point corner or apex at the intersection of a radial side 20d and diagonal side 20e.

With the exception of having one less side, a slightly different shape and length and a straight flat end surface 20g, the outer or end abrasive segments 22 at opposite sides or ends of the pulpstone 10 are otherwise substantially identical in construction size and shape to the corresponding portions of the center segments 20 described above. The end segments 22 are molded in the same molds used to mold the center segment but which have been modified by plugging one end of the cavity with an insert adapted to form a single straight end 20g instead of the usual intersecting diagonal sides 20e and 20f. Hence, a segment 22 molded therein will have a spaced pair of diagonal parallel groove 20b, an intervening abrading portion 20c and a pair of opposite radial sides 20d, only one diagonal side 20e and one diagonal side 20f at one end and a straight surface 20g at the opposite end thereof. Nevertheless, the segment 22 are also interchangeable,

reversible and interfit with either end of a center segment 20 to align the grooves 20b of adjacent segments 20 and 22. As shown the segments 20 and 22 and joint filler material 16 therebetween are assembled in a staggered pattern whereby each segment and circumferential row of segments including the joint material therebetween are displaced one half the circumferential width of the segments in the adjacent row. Thus, there is provided an interfitting, locking and supporting arrangment between segments and joint material interrupted by interving abrading portions.

As shown in Figures 1 and 3 the staggered pattern places each pair of diagonal opposite sides 20e and 20f of a center segment 20 spaced by joint filler material 16 opposite the same diagonal sides 20e and 20f of diagonally spaced adjacent center segments 20 and end segments 22.

Referring to Figures 6 and 7, the pulpstone may be constructed or similar hexagonal center segments 30 and pentagonal segments 32 (not shown) but simply indicated in Figure 6 by a dash line and straight end 30g, that are identical in every other respect to the segments 20 and 22 except that each has but a single diagonal groove 30b and abrading portions 30c of equal size. Each groove 30b is preferably wider than but extends substantially the same depth and distance relative to the boundary B' and ends of the bolt heads 18a as does the groove 20b. The single groove 30b extends diagonally from substantially the midpoint of one diagonally opposite side 30e, through the center or midpoint of the maximum length and circumferential width of the segment 30 located on the radial plane to substantially the midpoint of the opposite diagonal side 30e. Thus, the center segments 30 and end segments 32 molded in the same mold and manner taught above would likewise be interchangeable, reversible and interfit with the sides of adjacent segments sufficiently to align the grooves 30b of adjacent interfitting segments 30 and 32.

Preferably the single groove 30b has an outwardly flared or curved entrance of about 1-1/2" (3.8 cm) wide and opposite tapered sides tapering or converging toward each other from a convex surface of about 1/2" (1.27 cm) radius to a concave bottom of about 3/8" (9.5 mm) wide and 3/16" (4.76 mm) radius located at the boundary B' between the outer abrading and inner non-abrading portions of the segments and pulpstone constructed therewith.

A segmental pulpstone constructed with single diagonal groove preformed abrasive segments 30 and 32 and attached bolts 18 will have relatively long continuous wide diagonal grooves 30b and intervening abrading portion 30c of equal width equally spaced about the circumference of the pulpstone. In contrast the pulpstone 10 constructed with double diagonal groove preformed abrasive segments 20, 22 and attached bolts 18 has relatively long continuous narrower diagonal grooves 20b of equal width unequally spaced about the circumference by intervening abrading portions 20c of two unequal widths. Thus, the pulpstone 10 has equally spaced pairs of grooves 20b with about 50% of the abrading portions 20c of equal width therebetween equally spaced about the circumference by the remaining abrading portion 20c of equal but different width.

Further, the preformed grooved abrasive segments 20, 22, 30 and 32 need not be of the specific hexagonal and pentagonal shape shown but of any suitable reversible interchangeable polygonal shape segments symmetrical about radial and circumferential planes normal to each other and provided with one more diagonal grooves as taught above. For example, the shape of the abrasive segments may be square or rectangular or triangular. It is also conceivable to construct a pulpstone by assembling grooved and/or plain grooveless segments of different size, asymmetrical and symmetrical shapes in a particular sequence and interfitting patterns different from that disclosed herein. Alternatively, a pulpstone constructed with conventional plane grooveless segments may have the diagonal grooves 20b and/or 30b cut into the abrading portion thereof with a diamond, boron nitride or tungsten carbide grinding wheel or cutting tool.

Aside from the circumferentially spaced grooves 20b and 30b in the abrading surface to which the invention is directed, the pulpstone 10 may be of the type and constructed in substantially the same manner as those disclosed in U.S. Patents 2,421,885 and 3,227,611 with solid reinforced concrete cores and 2,745,226 and 2,769,286 with metal cylinder or drum-type cores. Hence, reference may be had to said patents for details not disclosed herein.

Briefly, a pulpstone 10 with a solid reinforced concrete core is constructed on and with the aid of a known transportable apparatus or fixture comprising a movable car or carriage, a horizontal base-plate with a vertical centering arbor on the car, a top plate, circular clamps, radial clamps, axial clamps and gaging means. A cage-like annular reinforcing unit R of smaller diameter and axial length than the pulpstone comprising a plurality of concentrically, radially, and axially spaced steel reinforcing rings and spacer elements is placed on the base plate and clamped concentrically about the center arbor.

A first circular outer row of end segments 22 and 32, then one or more inner rows of center segments 20 or 30, another circular outer row of end segments 22 or 32 and the joint filler strip 16 are assembled and clamped both circumferentially and axially together concentrically around the reinforcing unit R and the center arbor. The assembled cylinder of segments with joint filler strips compressed therebetween, the reinforcing unit R and the fixture on the movable car are moved into a kiln to cure and vulcanize the joint filler strips 16 and the adjoining abrasive segments together into a cylindrical unit.

Following curing, the assembly is moved out of the kiln, allowed to cool, and a two part drum or tubular molding arbor is fixed concentrically within the reinforcing unit R to form the central bore 14. The cavity between the outer cylinder of segments and the molding arbor is filled with concrete and allowed to cure sufficiently to remove it from the fixture, remove the molding arbor and from the end mounting surfaces of the core. The grooved pulpstone is then mounted on the drive spindle, rotated, and the peripheral abrading surface thereof is trued concen-

tric to the axis of rotation and the strip 16 cut out to extend the grooves 20b or 30b continuously through the joint filler strips 16 and segments.

In contrast a pulpstone with a metal cylinder or drum core is constructed by providing a metal cylinder of sufficient diameter, circumference, axial length wall thickness with the required number and pattern of holes necessary to receive the end portion 18c of the bolts and attach the prescribed number and arrangement of segments to the core.

The preformed grooved abrasive segments with attaching bolts are then attached to the metal cylinder with or without joint filler strip 16 between the segments and/or the core and segments by inserting the ends 18c through the holes provided in the cylinder wall. A washer and nut are then threaded on each bolt and tightened sufficiently to apply moderate tension to the bolts 18 and retain the segments against the cylinder and to compress the joint filler strip (when provided) therebetween. A pulpstone assembly, if it does have filler strips 16, is placed in an oven or kiln to cure and vulcanize the strip to the segments. In any event, the grooved pulpstone is then mounted on a drive spindle, rotated, and the abrading surface trued concentric to the axis of rotation and the strips cut out to extend the groove 20b or 30b through the joint filler strips and segments.

The heads 18a are preferably about 2-1/4" (5.7 cm) in axial length and provide with a 1-3/8" (35 mm) diameter × .5" (12.7 mm) pitch rolled thread. The adjacent opposite end portions 18b and 18c may vary in length and diameter. However, the opposite end 18b is preferably about 8" (15.2 cm) long with axially spaced annular beveled portions about 1-1/8" (2.85 cm) in diameter by 3/4" (19 mm) wide and intervening reduced portions about 5/8" (15.8 mm) in diameter by 3/4" (19 mm) wide.

Depending on the wall thickness of the drum-like core 12' the length of opposite end portion 18c will vary. Typically, the opposite end portion is about 5" (12.7 cm) long, 5/8" (15.8 mm) in diameter and has a 5/8" (15.8 mm) × 11 pitch threaded end of about 1-1/4" (3.2 cm) in length.

In both cases the bolts 18 are each formed of cold rolled steel bar or rod about 1-1/8" (2.85 cm) in diameter by about 7-1/4" or 8-1/4" (18.4 or 21 cm) long. One end portion of rod or bar is inserted between roll thread forming dies to displace the metal and form the threads and grooves of head portion 18a and the other machined to form the opposite end portions 18b or 18c.

The abrasive segments are preferably molded of a suitable vitrified bonded abrasive mixture and vitrified or fired in the known kiln and manner. The abrasive which may be of any suitable known type and grit size is preferably aluminum oxide or silicon carbide of from 24 to 100 grit size. Depending on size and shape, each segment 20 and 22 has at least one or more and preferably four spaced threaded holes 20a adapted for receiving the threaded portions 18a of the bolts 18. The threaded bores 20a which may extend radially 1-1/2" to 2-1/2" (3.8-6.4 cm) into the inner nonabrading portion of the segment are preferably molded to a depth of about 2-1/4" (5.7 cm), centrally located and spaced substantially equal diagonal distances from the center of the segment and hence, equal distances from both a central longitudinal radial plane and a central normal plane thereof perpendicular to each other. Preferably, the distance of the hole 20a from the central radial and central normal planes are about 1-5/8" (4.1 cm) and about 2-1/4" (5.7 cm) respectively. The bolts 18 are secured to the segments 20 and 22 preferably by filling each threaded hole 20a with a suitable known cement comprising for example a mixture of liquid phenolic resin and filler of fine abrasive or flint particles. The cement is allowed time to penetrate into and seal the pores in the adjoining area to provide a strong impervious waterproof joint between the stud and adjoining portion of the segment.

Excess cement is then poured out the threaded holes 20a and the heads 18a dipped into or brushed with additional cement are screwed into the threaded abrasive holes 20 and moderately tightened to about 40 ft pounds (5.5 m.kg.) of torque to prevent straining or stressing of the abrasive segments. The segment is then placed in an oven to cure the resin or cement and permanently fix the bolts head 18a to the segment which after curing is ready to be assembled to construct the pulpstone 10 in the well known manner.

Another embodiment of the invention is shown in Figure 8 comprising a reversible interfitting and interchangeable bonded abrasive center segment 40 and end segments 42 of polygonal or hexagonal and pentagonal shape for constructing a grooved segmental pulpstone. The segments 40 and 42 each comprises threaded bores 40a for heads 18a of bolts 18, a combination of three spaced diagonal grooves 40b, interrupted abrading surface 40c, opposite radial sides 40d and diagonally opposite sides 40e and 40f. The combination of diagonal grooves 40b comprises a single long central groove extending diagonally between the midpoint of opposite diagonal sides 40e through substantially the exact center of the segment and two shorter diagonal grooves extending substantially parallel to the central groove and in diagonally opposite direction from the center of each of the opposite ends to diagonally opposite corners of the segment 40.

Each of the diagonal grooves 40b is of substantially the same configuration and depth as the other grooves 20b and 30b. They may be of the same but preferably of slightly smaller width than grooves 20b.

Alternatively the combination of three grooves 40b may extend through the entire diagonal axial length of the segment as do the double grooves 20b and single groove 30b which may likewise be made shorter and to extend any part of the axial length of the segment as do the grooves 40b shown in Figure 8.

Further, it is also conceivable to extend only one or two of the three grooves 40b completely across the axial length of the segment and leave one or two shorter whereby the pulpstone would have both long continuous and discontinuous diagonal grooves.

As taught above a five sided pentagonal end segment 42 shown similar to end segment 22 but with three diagonal grooves 40b may be molded in the same mold as segment 40. The exception is that an insert is placed at one end to the mold to prevent formation of, alter, and essentially cut off one end of the segment 40 to form an end segment 42 with a straight flat end surface 40g and three grooves 40b.

An experimental grooved segmental pulpstone constructed according to the invention with double grooved bonded 60 grit size silicon carbide abrasive segments and a reinforced concrete core has been tested under actual pulp grinding conditions. The experimental pulpstone was mounted on a conventional pocket type grinder wherein logs of pulp wood arranged lengthwise were diametrically forced against and ground by the rotating interrupted diagonally grooved abrading surface of the pulpstone. Positioned at various places about the pulpstone were the usual number of conventional shower or spray nozzle assemblies directing cool shower water against and flooding the grooved abrading surface therewith.

Results of the test conducted over a substantially long period of time reveal that there were no occurrences of overheating, spalling, loosening, breaking and replacement or repair of any part or segment thereof. The quality of pulpwood fibers was as good and in some cases better than that produced with comparable plain grooveless pulpstone. Particles of pulpwood pressed into and tending to plug the pores of the abrading surface were more quickly removed by the centrifugally forced shower water and prevented the build-up of a blanket of wood pulp on the abrading surface and the resulting overheating and spalling of the segments.

The rotating spiral or inclined grooves caused an increase in the velocity of the shower water and wood fibers collecting therein to be propelled and quickly removed therefrom, prevented plugging of the pores, allowed penetration and circulation of the shower water through adjacent areas and removed the heat generated at the abrading surface. Also, observed was that the inclined abrading portions interrupted by the grooves tended to lift, in a shear-like fashion, longer fibers from the log due to the fact they cross at an angle to and progressively engage only a small portion of longitudinal surface of the log at any one time. Also, the pulpstone appeared to be freer cutting, maintained at a more uniform lower temperature and took less power to rotate and produce pulp.

CLAIMS

1. A grooved segmental pulpstone rotatable about a central axis thereof comprising a core, a plurality of abrasive segments with reducible outer abrading portions and surfaces and adjoining inner non-abrading portions and surfaces extending circumferentially about and attached to the core and providing the pulpstone with adjoining reducible outer abrading and inner non-abrading portions and surfaces, attaching means with a greater rate of thermal expansion than the segments fixed to and extending from the non-abrading portions of the abrasive segments and into the core for securing the segments to the core and a plurality of grooves circumferentially spaced about and interrupting the reducible outer abrading portion and surface extending inwardly a predetermined depth into the reducible outer interrupted abrading portion to bottoms thereof situated at predetermined fixed distances from and adjacent the attaching means, whereby during rotation and production of fibrous pulp the grooves collect, convey and allow cooling liquid normally showering and flooding the grooved outer abrading surface along through the grooves to wash out the pulp, penetrate into pores and circulate through adjoining porous areas and thereby more effectively cool the outer abrading portion and thus prevent overheating of the attaching means and resultant spalling, loosening, and breakage of the segments.

2. A grooved segmental pulpstone according to claim 1, wherein the bottoms of the grooves are situated in the outer abrading portion at a distance no greater than 1-1/4" (3.17 cm) from a circumferential boundary between the reducible outer abrading and inner non-abrading portions defined by ends of the attaching means, fixed to and extending from the non-abrading portion of the abrasive segments.

3. A grooved segmental pulpstone according to claim 1 or 2, wherein the grooves extend longitudinally at an angle to a direction of rotation and central axis of the pulpstone and wherein each abrasive segment comprises at least one groove extending diagonally in the reducible outer abrading portion between one end and an opposite end of the segment.

4. A grooved segmental pulpstone according to any one of the preceding claims, wherein each of the segments further comprises at least one bore of predetermined depth in the inner non-abrading portion adapted for receiving an end portion of the attaching means.

5. A grooved segmental pulpstone according to claim 4, wherein the attaching means comprises at least one metal bolt having an end portion extending into and fixed within the bore, in the non-abrading portion of each segment and an opposite end portion extending from the end portion and beyond the non-abrading portion into and fixed to the core.

6. A grooved segmental pulpstone according to claim 4 or 5, wherein the bore in the inner non-abrading portion is a threaded bore and the bolt has a threaded end portion threaded into and fixed within the threaded bore.

7. A grooved segmental pulpstone according to any one of the preceding claims, wherein each of the abrasive segments further comprises a pair of grooves extending diagonally through the reducible abrading portion between one end and an opposite end of the segment.

8. A grooved segmental pulpstone according to any one of the preceding claims, wherein a plurality of circular rows of the grooved abrasive segments of reversible, interfitting interchangeable, polygonal shape arranged about the core with joints between adjacent segments staggered relative to the joints

between segments of an adjacent circular row of segments whereby the diagonal grooves in the segments of adjacent circular rows are aligned with each other and extend across at least a portion of each segment of the pulpstone.

9. A grooved segmental pulpstone according to any one of the preceding claims, wherein the core comprises a reinforced solid concrete core adapted for mounting on a drive spindle and wherein the opposite end portion of the metal bolts have one or more axially spaced grooves and are embedded in the concrete core.

10. A grooved segmental pulpstone according to any one of claims 1 to 8, wherein the core comprises a preformed hollow metal cylinder including a wall adapted for mounting on a drive spindle and with holes in the wall for receiving the opposite end portions of the metal bolts and wherein the opposite end portions of the metal bolts have threaded ends, extend through the holes in the wall and are attached to the core by nuts threaded thereon sufficiently to hold the segment on the core.

11. A grooved abrasive segment for constructing a grooved segmental pulpstone comprised of a number of said grooved segments assembled about and attached to a core, which comprises a bonded abrasive segment of interfitting interchageable reversible, polygonal shape, predetermined axial length and circumferential width having a reducible outer grooved abrading portion and surface interrupted by at least one diagonal groove extending diagonally between one end and an opposite end of the abrasive segment and inwardly a predetermined depth to a bottom of the groove, an inner non-abrading portion and surface adjoining the reducible outer grooved abrading portion and having at least one bore extending into the inner non-abrading portion from the inner surface thereof, and at least one bolt for attaching the abrasive segment to the core each having a greater rate of thermal expansion than the segment wherein one end portion of the bolt is inserted into a bore and fixed to the inner non-abrading portion with its end at and defining a circumferential boundary between the inner non-abrading and outer abrading portions situated at a distance no greater than 1-1/4" (3.17 cm) from the bottoms of the grooves, and an opposite end portion adjacent to and extending from the one portion is adapted for attachment to the core of the pulpstone.

12. A grooved abrasive segment according to claim 11, wherein the non-abrading portion has at least one threaded bore and each bolt has a threaded end portion threaded into the threaded bore and fixed to the non-abrading portion of the segment.

13. A grooved abrasive segment according to claim 11 or 12, wherein at least one diagonal groove extends substantially through and intersects the center of the reducible outer abrading portion and surface of the segment.

14. A grooved abrasive segment according to any one of claims 11 to 13, wherein the outer abrading portion has a pair of spaced diagonal grooves extending substantially parallel to each other and in opposite directions between the midpoint of the one and the opposite ends of the segments and diagonally opposite corners of the segments.

15. A grooved abrasive segment according to any one of claims 11 to 14, wherein the opposite end portion of each bolt has one or more axially spaced grooves and is adapted to be embedded in a reinforced concrete core.

16. A grooved abrasive segment according to any one of claims 11 to 15, wherein the opposite end portion of each bolt has a threaded end and is adapted to extend through holes in the wall of a hollow cylindrical core and attached to the core by nuts threaded thereon sufficiently to hold the segment to the core.

17. A grooved abrasive segment according to any one of claims 14 to 16, wherein the outer abrading portion further comprises a central diagonal groove extending between the pair of spaced diagonal grooves through and intersecting the center of the reducible outer abrading portion and surface of the segment.

18. A grooved segmental pulpstone rotatable about a central axis thereof or a grooved abrasive segment substantially as herein described with reference to any one of the figures of the accompanying drawings.

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